Small Business Innovation Research/Small Business Tech Transfer

Requirements Management with Bidirectional Traceability in Modern Version Control Systems, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

Airborne software processes are required to comply with existing aviation design assurance level procedures to ensure safety. However, the use of the existing procedures for unmanned aerial systems (UAS) is expensive, slow and not scalable. Cost estimates for certification are around $100-150 per line of code, which drives up cost significantly in any program.

A new tool called Tracer is proposed to manage requirements, from the system-level objectives all the way down to software requirements and the corresponding code and test cases, enabling stakeholders and engineers to identify bidirectional impacts of changes to requirements or system code and test cases. Tracer accomplishes this by:

a) leveraging modern software development best practices such as version control and review process for all artifacts in the process (requirements, test cases, etc., in addition to code)

b) allowing for the entire process to exist within a single tool and platform that builds off of the the git-based systems that engineers already use for development.

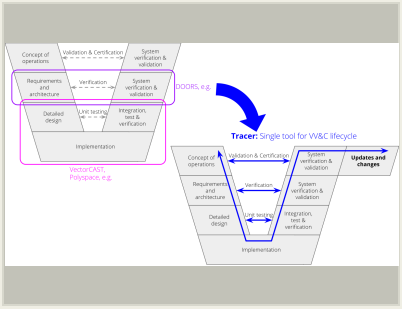
Taking the form of a lightweight addin for git, the tool facilitates generation of reports, generation of requirements traceability matrices, visualization of dependency trees, and various enforcements of dependencies and links. The enforcements are especially powerful in easing entry into the world of certified aerospace systems for new entrants to the industry. There are also extensive capabilities to enable rich and transparent cloud-based collaboration, enabling strong links between customers, regulators, performers, and other stakeholders.

Current practices use separate often expensive tools for each part of the chain, with significant costly and error-prone manual overhead required in creating and maintaining links. Tracer is expected to make the certification process more efficient, faster, and less expensive, especially for re-certification efforts integrating updated code by enabling agile verification and validation of changes.

Anticipated Benefits

Tracer is a distributed tool accessible and transparent to any number of stakeholders in a project, and has the potential to be used for any large NASA project. Examples of this include developing requirements for UTM or managing requirements for an X-plane program. It also addresses the goals of the Convergent Aeronautics Solutions (CAS) project by introducing software development best practices to aeronautics systems engineering and reducing the cost of certification - a significant barrier.

Tracer is intended for sale to manufacturers of certified systems, which may



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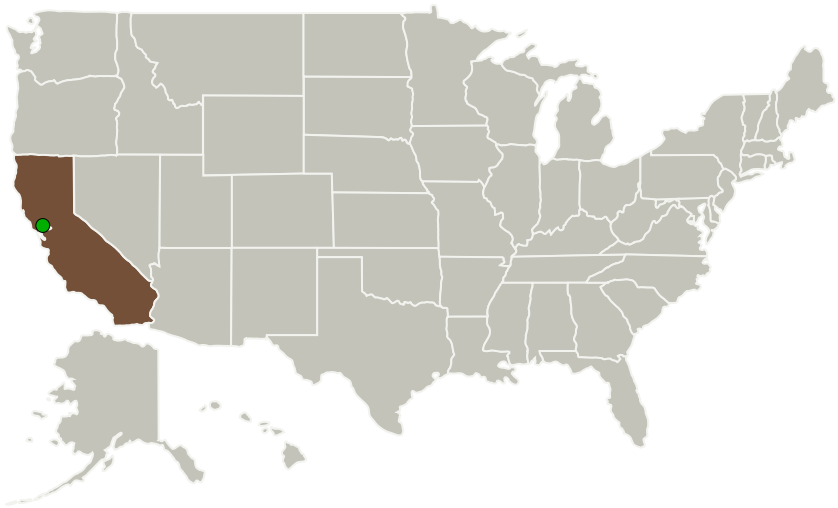
range from small UAS up to manned Part 25 aircraft. Licensed users will also include other stakeholders (e.g., FAA representatives in a certification effort, program managers owning requirements). An additional opportunity is to provide pre-certified, packaged sets of requirements and test cases. These could be sold to manufacturers to reduce the cost and complexity of in-house requirement building and certification.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Xwing, Inc	Lead Organization	Industry	San Francisco, California
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Xwing, Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

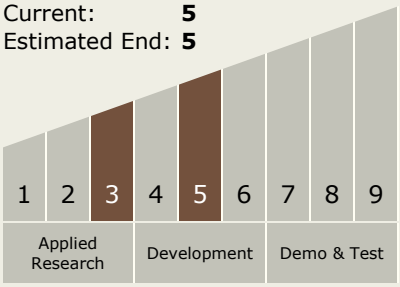
Carlos Torrez

Principal Investigator:

Ovidiu Gheorghioiu

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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Project Transitions

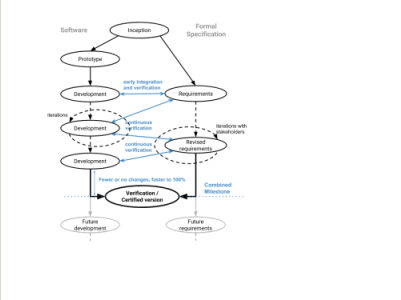
July 2018: Project Start

February 2019: Closed out

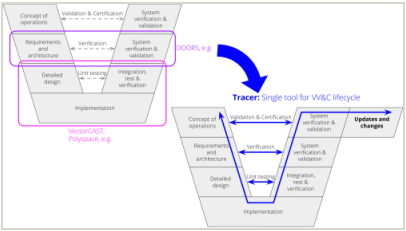
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141268)*

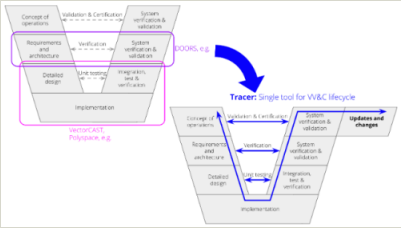
Images



Briefing Chart Image
Requirements Management with Bidirectional Traceability in Modern Version Control Systems, Phase I *(https://techport.nasa.gov/image/127523)*



Briefing Chart Image
Requirements Management with Bidirectional Traceability in Modern Version Control Systems, Phase I *(https://techport.nasa.gov/image/128476)*



Final Summary Chart Image
Requirements Management with Bidirectional Traceability in Modern Version Control Systems, Phase I *(https://techport.nasa.gov/image/129591)*

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.7 Computational Fluid Dynamics (CFD) Technologies

Target Destination

Earth